

HMT Linkage to Weather & Water's Science, Technology & Infusion Program

Marty Ralph

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ST&I Management

Program Manager: Marty Ralph, OAR

Coordinator: Ward Seguin (OAR), Co-Coordinator: Lee Stang (NWS)

Budget: D. Jiron, L. Melville (NWS), M. Blades, K. Jones (OAR)

What is ST&I?

ST&I is a matrix program that enables improvements in NOAA's Weather & Water services, including impacts on Commerce & Transportation and Climate services.

This requires

- meeting the short-term needs of its NOAA and other customers, as well as
- conducting long-term research that leads to breakthrough advances in services.

Program Baseline Assessment

ST&I “Capabilities”

- **R&D for Water Resources Observations and Forecast Information**
- R&D for Hurricane Observations and Prediction
- R&D Weather and Water Support for Transportation
- R&D for Severe Thunderstorms, Tornadoes, Hazardous Weather Forecasts and Warnings
- R&D for Marine and Coastal Weather
- R, D, and A (Acquisition) for Observations
- R, D and A for IT
- Education and Outreach
- Agency, Interagency and International Grants Program
- Weather-Climate Connection
- Tsunami Warnings

Program Overview

ST&I's Primary Customers

- Local Forecast and Warnings Program
- Hydrology Program
- Environmental Modeling Program
- Coasts, Estuaries, Oceans Program
- Climate Mission Goal
- Commerce & Transportation Mission Goal
- Other Agencies needing ST&I expertise (e.g., DoD, FAA)

Program Overview

ST&I Outcomes

Short-term: operational use of new science and technologies transferred to operations. Results of research, development, and testbed evaluations occurring over preceding one to five years.

Mid-term: key decisions to implement observing systems, data assimilation systems, numerical models, and information technology as a result of research, prototype development, and testbed evaluations

Long-term: decisions to investigate emerging technologies and develop prototype observing, modeling, and IT systems as result of assessments of emerging science and technological opportunities

Program Overview

ST&I Program Elements

| | Line Office | FY04 Approp | FY05 Pres. Bud. | FY06 | FY07 |
|-----------------------------------|-------------|----------------|--------------------|-------|-------|
| AOML/HRD | OAR | 4.00 | 4.10 | 4.10 | 4.10 |
| ETL | OAR | 6.19 | 6.33 | 6.33 | 6.33 |
| FSL | OAR | 5.82 | 5.93 | 5.93 | 5.93 |
| NSSL | OAR | 7.70 | 7.97 | 7.97 | 7.97 |
| PMEL | OAR | .26 | .28 | .28 | .28 |
| USWRP-incl Thorpex (2.3) | NWS | 0 | 6.55 | 6.55 | 6.55 |
| USWRP (Thorpex) | OAR | 5.15 | 0.0 | 0.0 | 0.0 |
| Targeted Wind Sensing | OAR | 1.88 | 0.0 | 0.0 | 0.0 |
| Tornado severe storm Research | OAR | .99 | 1.01 | 1.01 | 1.01 |
| Remote sensing research | OAR | .50 | 0.0 | 0.0 | 0.0 |
| Storm U. of N. Iowa | OAR | .49 | 0.0 | 0.0 | 0.0 |
| Phased Array Radar (Eng) | OAR | .020 | 0.0 | 0.0 | 0.0 |
| High Resolution Temp. Fore. Pilot | NWS | 4.16 | 0.0 | 0.0 | 0.0 |
| ASOS | NWS | 5.07 | 5.13 | 5.13 | 5.13 |
| AWIPS | NWS | 13.99 | 14.13 | 14.13 | 14.13 |
| NEXRAD | NWS | 11.38 | 11.86 | 9.85 | 9.85 |
| Radiosonde Replacement | NWS | 6.92 | 6.99 | 6.58 | 0.0 |
| All Hazards WCS | NWS | 5.44 | 0.0 | 0.0 | 0.0 |
| COOP -M | NWS | | 1.40 | 1.40 | 1.40 |
| NPOESS Preparatory Data | NESDIS | | | 4.50 | 4.50 |
| Coastal Adv. Polar Data | NESDIS | 2.47 | 3.00 | 1.00 | 1.00 |

Program Overview

ST&I as a “Matrix Managed” Program

| LINE OFFICE | CURRENT PROGRAM |
|-------------|-----------------|
| NWS | 48% |
| OAR | 46% |
| NESDIS | 6% |

| ST&I “STRATEGY” | CURRENT PROGRAM |
|-----------------|-----------------|
| Science | 30% |
| Technology | 20% |
| Infusion | 50% |

Program Shortfalls in ST&I's FY07-11 PBA*

Major Thrusts and NOAA Program Plan Decisions

| ST&I Thrust | 100% Requirement (\$K) | Top 10% GAP (\$K) | NOAA PDM Jan '05 (\$K) |
|--|-------------------------------|--------------------------|-------------------------------|
| Water Resources-Hydrometeorological Testbed (Improve Quantitative Precipitation Forecasting) | 5749 | 1900 | 800 (HMT) |
| AWIPS (Next Generation AWIPS is needed) | 12078 | 4030 | 0 |
| Integrated Observations (Optimization & infusion of New Observations) | 21018 | 3500 | 3800 (UAV) |
| Total | 39531 | 9430 | 4600 |

*Includes roughly half of total gaps identified in 100% requirements.

ST&I Hydrometeorological Testbed (HMT)

PROGRAM ADJUSTMENT

- **GOAL:** Weather and Water
- **PROGRAM:** Science, Technology & Infusion
- **CAPABILITY:** R&D for water resources data/information
- **REQUIREMENT:** Improve water resource information
- **DESCRIPTION OF ADJUSTMENT:** Increase ST&I R&D capacity to help improve NOAA HYD services
 - HMT (better QPF: R&D + new forecast tools)
 - Weather-Climate Connection (atmospheric rivers)
 - Hurricane precipitation (orographic effects, floods)
 - Use new satellites (Global Precip. Mission-GPM)
- **PERFORMANCE MEASURES:**
 - Demonstrate QPF GPRA score acceleration in testbed: double current rate of improvement of service GPRA
 - Improved data spatial/temporal density in testbed
 - Number of testbed projects completed
 - Number of field studies & observing systems tests
 - Number of physical processes better understood

BENEFITS AND RISKS

- Accelerates QPF improvements and addresses NOAA's Research Plan, AGM, NWS, ST&I priorities
- Reduces ST&I dependency on reimbursables
- New tools/models developed/tested & transitioned
- Slow QPF improvements if not implemented
- Effort required to forge research/operations cooperation
- Accurate water quality forecasts require accurate QPF
- Links OAR & NESDIS to NWS/OHD, RFCs and NCEP

FUNDING

| | | | | | | |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
| <i>(FY\$M):</i> | FY06 | FY07 | FY08 | FY09 | FY10 | FY11 |
| <i>Current Program</i> | 1721 | 1721 | 1721 | 1721 | 1721 | 1721 |
| <i>Program Adjustment (With</i> | 0 | 800 | 800 | 800 | 800 | 0 |
| <i>Program adjustment (Above Core)</i> | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Proposed Program</i> | 1721 | 2521 | 2521 | 2521 | 2521 | 1721 |
| <i>CAPABILITY: Focused R&D and forecast tool development</i> | | | | | | |
| <i>QUANTITY: Number of major field studies and infusion projects</i> | | | | | | |
| <i>Input Capacity Change</i> | FY06 | FY07 | FY08 | FY09 | FY10 | FY11 |
| <i>Capacity (+/-) Field studies</i> | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Capacity (+/-) Physics/senso</i> | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Capacity (+/-) Improve forec</i> | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Output Capacity Change</i> | FY06 | FY07 | FY08 | FY09 | FY10 | FY11 |
| <i>Capacity (+/-) Improved QPI</i> | 0 | 0 | 0 | 0 | 0 | 0 |

ACTIVITIES, SCHEDULE & MILESTONES

- ST&I researchers will be moved from non-NOAA reimbursables to NOAA HMT projects (salaries)
- NWS forecasters test new tools (NCEP, RFCs, OHD)
- Field studies will be conducted, starting on American River of California, and upstream over Pacific Ocean jointly with HYD (equipment, travel, expendables)
- FY05-06: planning, field sites identified, interagency involvement developed, initial deployments from current program + HYD program adjustment
- FY07-08: field study on American River (winters)
- FY09-11: transition to eastern watershed (hurricanes)
- FY05-11: scientific analysis and forecast tool development/testing/transitioning (improve models)

ST&I Performance Measures

Marty Ralph

Core issues:

- How to measure science and technology research performance?
- How to measure effectiveness of ST&I in improving NOAA's services?
- Should ST&I's performance be measured purely by GPRA score improvements?

Constraints:

- Science and Technology advances are a foundation of NOAA's service improvements, yet are often not initially measurable in the "service" GPRA scores.
- Improving the "service" GPRA scores requires "service" programs to adopt new methods, yet this may have a cost & require services to let go of existing methods.
- The "responsibilities" of a program must be aligned with its "authority" to act, yet in the case of ST&I, the primary authority for forecasting lies in other programs.
- While research suggests fast improvements in GPRA scores may be possible, operational goals must be reasonably achievable or the risk of failure is increased.

A solution is to use a combination of:

- Internal measures suitable for state-of-the-art science & technology development
- "Infusion" oriented measures, including testbed demonstrations of GPRAs
- Internal measures in "service" programs tracking implementation of infusion, i.e., measure the services' "pull" for science and technology

Performance Measures for ST&I as an “Enabling” Program*

Science:

- Forecast-critical physical processes better understood or described (#/year)
- Operational forecast models, parameterizations or tools evaluated (#/year)
- Major field projects conducted and data sets created (#/year)
- Peer-reviewed papers published (#/year)

Technology:

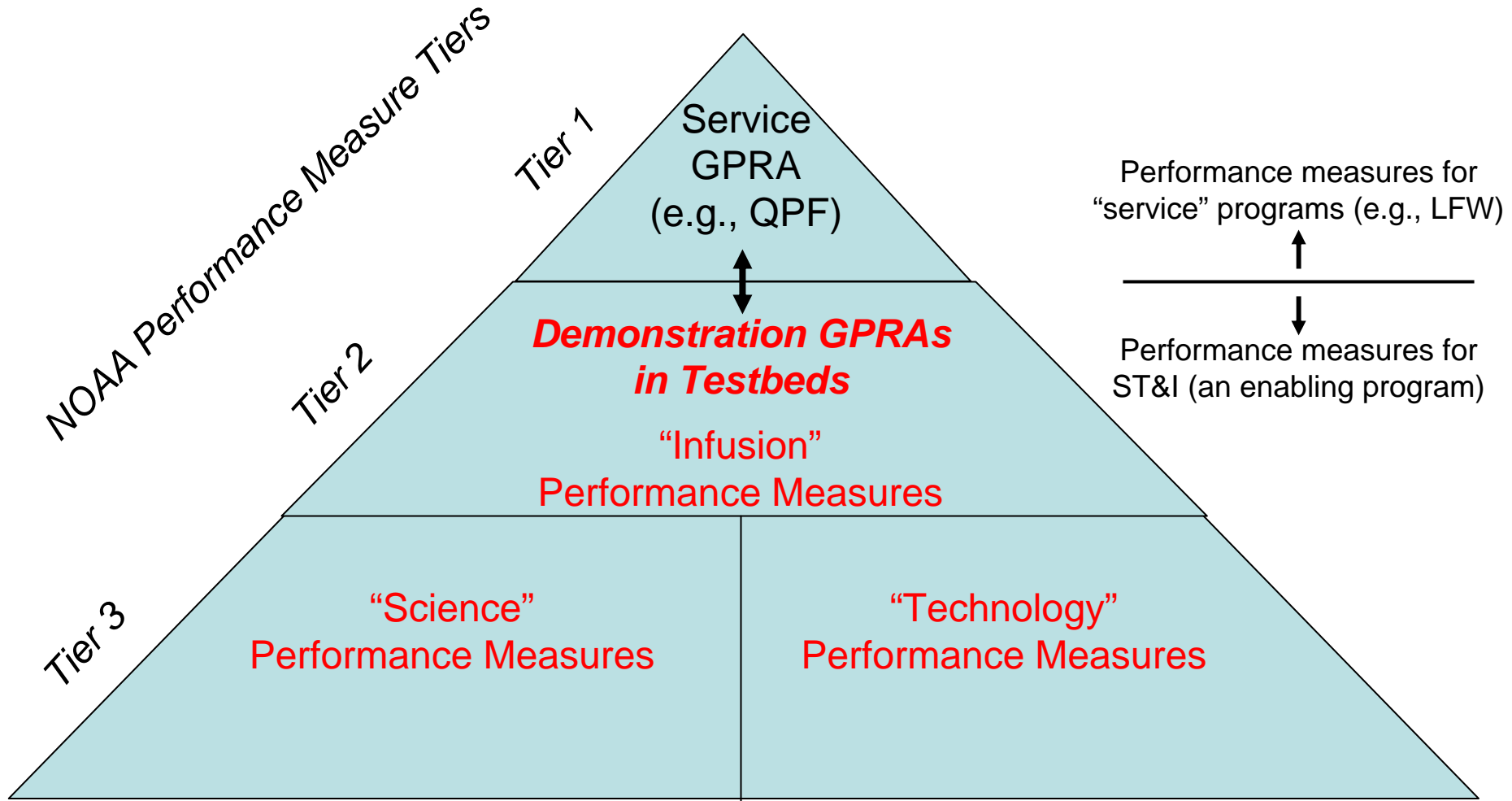
- New sensors, subsystems or observing strategies developed or tested (#/year)
- Alternative integrated observing system approaches evaluated (#/year)
- IT systems or major subsystems developed or tested (#/year)

Infusion:

- Testbed demonstration projects completed (#/year)
- New or improved forecast models, tools or algorithms delivered (#/year)
- New sensors acquired or deployed for operations (#/year)
- Forecaster training modules created or presented (#/year)

**These are what were included in ST&I's PBA submitted 23 July 2004.*

Linking ST&I Performance Measures to GPRAs



**Marty Ralph (ST&I Program Manager)*

Use of “Demonstration GPRA” in Testbeds

Concept:

- GPRA score goals can be set higher in Testbeds than in full operations
- Adoption of new methods for full operations requires proof of concept
- Proof-of-concept can be demonstrated by limiting tests to small areas, times, tools
- By limiting the scope of tests, the costs can be kept within reasonable bounds
- Researchers and forecasters jointly define strategies to demonstrate impacts on the suitable “Demonstration GPRA” goal (e.g., QPF) during the tests.
- If tests show regional improvement, extend results nationally with follow-up testing

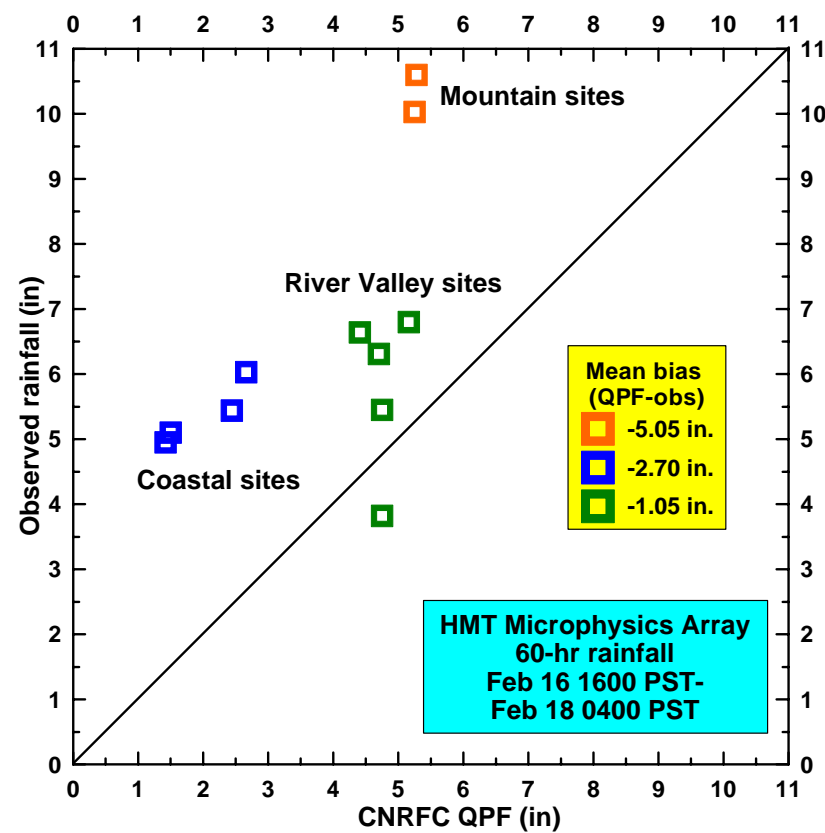
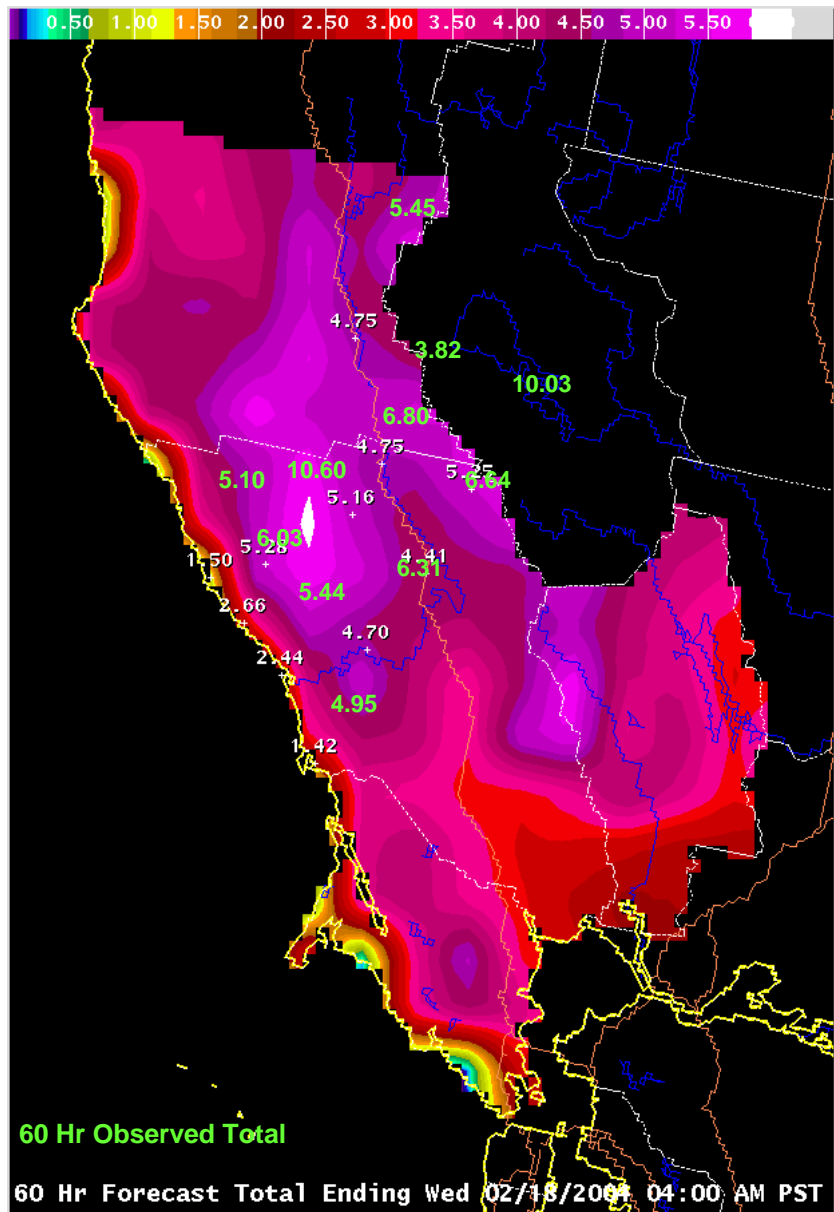
Recent experience:

- This demonstration concept has been the de-facto approach to date
- NCEP uses it to evaluate whether model changes should be adopted operationally
- Joint Hurricane Testbed uses this approach
- Warning decision support tools turn new data into forecast usable information
- New England Temperature Forecasting Pilot Study demonstrated regional improvements and then applied results nationally

Use in ST&I:

- From recent successes, develop “best practices”
- Requires investments in ST&I focused on Testbeds (e.g., JHT and HMT)
- Requires investments from “Service Programs” and commitment to try new ideas

Improve Quantitative Precipitation Forecasting (QPF)



Preliminary comparison between predicted (CNRFC 0-60 h QPF) and observed storm-total rain (00Z 16 Feb–12Z 18 Feb '04)

Next Steps

ST&I FY08-12 Program Baseline Assessment – “current program” and “gaps”:

- ST&I Capability team reviewing last year’s PBA
- This meeting will help the PBA development process to define 100% program
- Gap analysis will be performed
- Develop alternatives to fill gap (include gaps in obs, models, tools, understanding)
- Create “Demonstration GPRAs”

How to get from here to FY07:

- Current program includes major investments by ETL and NSSL, and leveraging
- FY06 Hydrology Plan includes resources linking HMT and DMIP-II etc...
- A key gap is ability of time for NWS forecast experts to devote to HMT tests

The Operational “handoff”:

- How to plan and implement the handoff to operations after testing? Are gaps present in HYD, LFW, CEO that should be identified to adopt or absorb new tools/methods?
- Link to new NOAA Policy on Transitioning research to Applications
- Assess user benefits